

### **REMARKS**

Favorable reconsideration is respectfully requested.

The claims are 16-32.

Claims 16 and 25 are currently amended.

New claims 31 and 32 are added.

Support for the amendment to claims 16 and 25, and new claims 31 and 32, may be found, for example, in paragraph [0012] of the present specification.

No new matter is added.

### **Claim Rejections – 35 USC §103**

Claims 25-29 are rejected under 35 USC §103(a) as being unpatentable over Gronbeck et al. (U.S. 6,803,171).

Claims 16-24 and 30 are rejected under 35 USC §103(a) as being unpatentable over Gronbeck et al. in view of Kodama et al. (U.S. 5,891,603).

Applicants respectfully traverse each of these rejections.

#### *The Present Invention*

An alkali-soluble resin used in a chemical-amplification type silicone-based positive-working resist composition is typically a ladder-type silicone copolymer made up of: (a<sub>1</sub>) (hydroxyphenylalkyl)silsesquioxane units, (a<sub>2</sub>) silsesquioxane units with a substituent group readily decomposable with an acid, and (a<sub>3</sub>) alkyl- or phenylsilsesquioxane units.

The aforementioned substituent groups that are readily decomposable with an acid usually include *tert*-butoxy groups, *tert*-butoxycarbonyl groups, cyclohexyloxyalkyl groups, and the like. However, in synthesizing these compounds, it is laborious to introduce these groups into ladder-type silicone copolymers due to the very difficult procedures which must be used.

In the present invention, success has been achieved in obtaining a chemical-amplification type silicone-based positive-working resist composition without the attendant difficulties, via the

combined use of a ladder-type silicone copolymer containing readily available (alkoxyphenylalkyl)silsesquioxane units with a dissolution inhibitor, the (alkoxyphenylalkyl)silsesquioxane being a non-acid decomposable unit having a linear alkoxy group of 1-4 carbon atoms. See claim 16.

*Distinctions over the cited art*

Gronbeck et al. disclose a chemical-amplification type silicone-based positive-working resist composition that was known in the art before the present invention. Namely, the (a<sub>2</sub>) unit is a monomer having a group readily decomposable with an acid such as a *tert*-butoxycarbonyloxy group or a cyclohexyloxy group. See column 12, line 36 to column 15, line 55.

Since there is no need to use a dissolution inhibitor in the prior art compositions, in the positive-working resist compositions of Gronbeck et al. no dissolution inhibitor is used. Accordingly, Gronbeck et al. do not disclose or suggest all of the limitations of claim 1 which includes a dissolution inhibitor. Furthermore, it would not be obvious to modify the Gronbeck et al. compositions to include a dissolution inhibitor since, as mentioned, dissolution inhibitors were not needed in prior art compositions.

The Examiner's position is that Gronbeck et al. teach a terpolymer containing repeat units of phenylsilsesquioxane, hydroxybenzylsilsesquioxane and *t*-butoxycarbonato benzylsilsesquioxane (the *t*-butoxycarbonato group being a photoacid-labile ester group), specifically, in Example 30. See Official Action, pages 2-3. Gronbeck et al. also teach the equivalence of the photoacid labile ester group and a photoacid labile acetal group, such as the one formed by grafting *t*-butylvinyl ether onto a phenolic hydroxyl moiety. See column 8, lines 44-64, and claim 2. Thus, the Examiner concludes, it would have been obvious to one of ordinary skill in the art to use a terpolymer having repeat units of phenylsilsesquioxane, hydroxybenzylsilsesquioxane, and *t*-butoxy benzylsilsesquioxane with a reasonable expectation of obtaining a bilayer resist that has a controlled dissolution rate with little or no loss of photospeed.

The Examiner assumes that the units represented by Formulas I to III of Gronbeck et

al. correspond to the units (a<sub>3</sub>), (a<sub>1</sub>), and (a<sub>2</sub>) respectively of the present invention. This means that the variable R<sup>2</sup> in Formula III of Gronbeck et al. corresponds to the alkyl part of the alkoxy group of the present (a<sub>2</sub>). See claim 16. However, as is disclosed in column 12, line 60 to column 13, line 10 of Gronbeck et al., R<sup>2</sup> is an acid cleavable group, and may be an optionally substituted noncyclic alkyl moiety having 6 or more carbon atoms. As disclosed on page 6, paragraph [0015] of the present specification, the (a<sub>2</sub>) unit in the present invention controls the alkali-solubility. Therefore, the number of the carbon atoms in the alkyl group should be 1 to 4 as presently recited in claim 16. Accordingly, there is no motivation or suggestion to one of ordinary skill in the art to modify the compositions of Gronbeck et al. to arrive at the present invention.

Further, the Examiner alleges that it is well known in the art that one can either use a two-component system (a resin having acid-decomposable group and a photoacid generator) such as Gronbeck's chemically amplified resist, or a three-component system (an alkali soluble resin, a photoacid generator, and a dissolution inhibitor) as disclosed in Kodama et al. See Kodama et al., column 2, lines 48-59. The Examiner then concludes that it would have been obvious to one of ordinary skill in the art to use a terpolymer of the present invention as Gronbeck's polymer in his Example 30.

The invention of Kodama et al. relates to non-silicone chemical-amplification resist compositions. However, non-silicone resins have a low resistance to oxygen plasma and are therefore unacceptable as a material for a bilayer resist. These disadvantages can be overcome by the present invention by using a silicone resin to obtain higher resistance to oxygen plasma. Accordingly, Kodama et al. relates to nonanalogous art with respect to Gronbeck et al. and there is no motivation to combine.

The alkali-soluble resin composition of the present invention comprises a ladder-type silicone copolymer, the (a<sub>2</sub>) unit being a unit with no acid decomposability, such as an (alkoxyphenylalkyl)silsesquioxane with a linear alkoxy group of 1 to 4 carbon atoms. It could only be determined through a significant amount of actual experimental work, whether or not the behavior of such a resin, combined with a dissolution inhibitor, is similar

to that of a resin containing a monomer having a solubility-reducing group as the (a<sub>2</sub>) unit.

Accordingly, the present invention is not disclosed or suggested by Gronbeck et al. alone, or by Gronbeck et al. in combination with Kodama et al.

No further issues remaining, allowance of this application is respectfully requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact undersigned at the telephone number below.

Respectfully submitted,

Taku HIRAYAMA et al.

By: J. Mark Konieczny  
J. Mark Konieczny, Ph.D.  
Registration No. 47,715  
*for*  
Matthew M. Jacob  
Registration No. 25,154  
Attorney for Applicants

MJ/JMK/aas  
Washington, D.C. 20006-1021  
Telephone (202) 721-8200  
Facsimile (202) 721-8250  
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